

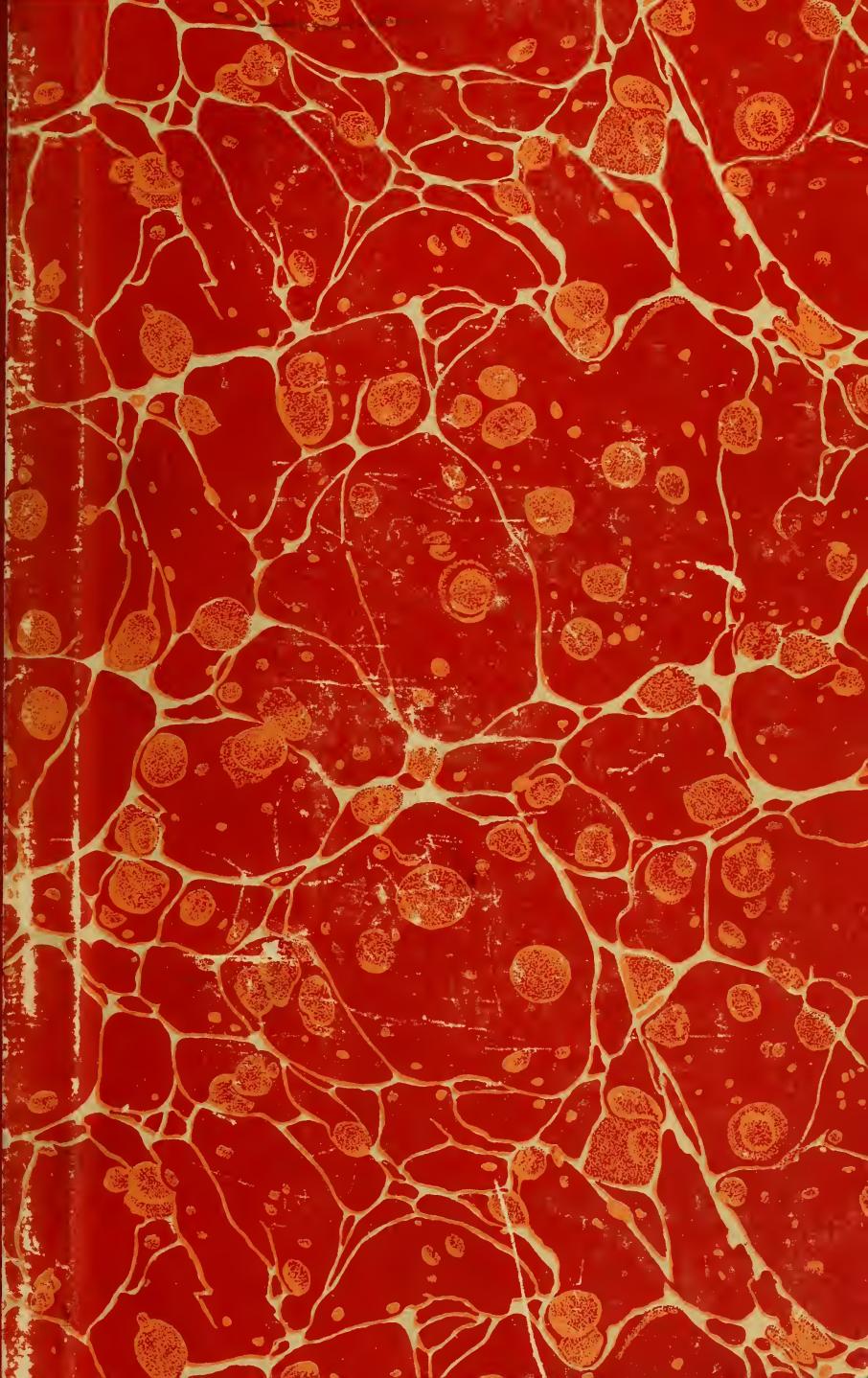
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U. S. DEPARTMENT OF COMMERCE

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**For a partial list of previous research papers appearing
in BUREAU OF STANDARDS JOURNAL OF RESEARCH
see pages 2 and 3 of the cover**

HEAT OF VAPORIZATION OF WATER AT 50°, 70°, AND 90° C.

By E. F. Flock and D. C. Ginnings

ABSTRACT

The values of the heat of vaporization of water at 50°, 70°, and 90° C. have been determined as 2,381.6, 2,333.6, and 2,283.4 international joules per gram. These results were obtained subsequent to the publication of a detailed report on calorimetric determinations of thermal properties of saturated water and steam. The measured values below 100° are in excellent agreement with those obtained by extrapolation from the measurements above 100° C.

Thermal properties of saturated water and steam in the range from 0° to 270° C., as measured at this bureau, have already been published.¹ The determinations of heat of vaporization given before extended from 100° to 270° C. Since the publication of the first paper it has been possible to extend the measurements of heat of vaporization down to 50° C. These measurements have been carried out under the direction of N. S. Osborne and H. F. Stimson. This brief report is given as a supplement to the previous detailed description. The apparatus, manipulation, notation, and reduction of the data are essentially unchanged.

The results of the more recent experiments are given in detailed form in Table 1.

¹ B. S. Jour. Research, vol. 5 (RP209), pp. 411-480, 1930.

TABLE I.—Principal data from γ experiments below 100°C .

$$\gamma_1 = \frac{1}{\Delta M} \left\{ Q_B + Q_P + Q_L - [Z + M_2 \alpha]^2 \right\} + \frac{\Delta H'}{\Delta M} (\theta_1 - \theta_m)$$

286-Q	do	70.003	70.012	20	14.259	278.4	33, 218.7	74.6	.2	-18.1	33, 275.4	2, 333.6	-1.3	
286-II	do	70.012	70.008	20	14.264	264.1	33, 214.9	74.6	-.2	4.5	33, 293.8	2, 334.1	-2	
286-I	do	70.008	70.000	20	14.273	249.9	33, 210.9	74.6	-.2	17.1	33, 302.4	2, 333.2	-6	
286-J	do	70.000	70.008	20	14.255	235.6	33, 207.7	74.6	0	-14.0	33, 267.4	2, 333.7	-2	
286-K	do	70.006	70.000	20	14.258	186.9	33, 196.8	74.6	-.4	9.0	33, 280.0	2, 334.1	.2	
<i>Z₇₀=869 int. joules per °C.</i>														
Even temperature 70° C.														
295-A	Aug. 15, 1930	89.925	89.918	20	16.802	312.5	38, 298.0	70.6	.7	14.6	38, 335.9	2, 284.3	.5	
295-B	do	89.918	89.924	44	36.892	275.6	84, 102.4	155.3	.9	.6	84, 259.2	2, 283.7		
295-C	do	89.918	89.924	20	16.760	285.8	38, 224.3	70.6	0	-11.8	38, 288.1	2, 284.2	.3	
295-D	do	89.924	89.920	26	21.782	237.1	49, 671.0	91.8	-.2	7.4	49, 770.4	2, 284.9		
295-E	do	89.920	89.920	20	16.760	220.3	38, 191.9	70.6	-.5	-1.4	38, 261.6	2, 282.9	1.0	
295-F	do	89.920	89.916	27	22.602	197.7	51, 153.4	95.3	-1.1	8.3	51, 637.9	2, 284.7	-1.0	
295-G	do	89.916	89.916	20	16.753	180.9	38, 163.9	70.6	0	-1.2	38, 239.3	2, 282.5	.7	
<i>Z₇₀=885 int. joules per °C.</i>														
Even temperature 90° C.														
295-Q	do	89.916	89.916	20	16.88	4.168	int. joules per °C.				Mean value of $\gamma_{70} = \gamma_{90}$	2,283.7	int. joules per g	-1.4

Table 2 shows the reduced results of the experiments at low temperatures. The values of β in column 3 were calculated from the equation $\beta = \frac{Lu}{u' - u}$, using the values of u' given by Keyes and Smith.²

TABLE 2.—*Heat of vaporization (L) of water at 50°, 70°, and 90° C.*

Temperature θ	γ observed	β calculated	L	
			Observed	Calculated
°C.	Int. joules/g	Int. joules/g	Int. joules/g	Int. joules/g
50.....	2,382.0	0.2	2,381.8	2,381.6
70.....	2,333.9	.5	2,333.4	2,333.6
90.....	2,282.7	1.0	2,282.7	2,283.4

NOTE.—The values of L shown in column 5 were calculated from the equation

$$L = 0.002562(374 - \theta)^2 - 5.883(374 - \theta) + 249.9(374 - \theta)^{\frac{1}{2}} - 113(374 - \theta)^{\frac{3}{4}}$$

This equation, which was fitted to the observed values of heat of vaporization above 100°, holds equally well for the observations down to 50° C.

WASHINGTON, January 6, 1932.

² Mechanical Engineering, vol. 53, pp. 132-135; 1931.

